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ABSTRACT

To simplify data from a large survey, it is desirable to classify subjects according to their attitudes toward certain issues, as measured by questions in the survey. Responses to 12 questions were identified as indicative of attitudes toward deschooling education. These attitudes were explained by means of patterns exhibited within the responses given to some questions which best discriminate between people for and against deschooling education. Because limited relevant information is available on this subject, the approach taken was to build an a-posteriori index to describe the attitude under study. The index was obtained by running a canonical correlation between a set containing information from the 12 attitudinal questions, and another set containing information from 52 explanatory questions that were most relevant to the study. This analysis produced canonical variates and each of these was taken as the index for each set. Based upon actual distribution of index values, subjects were associated with a "clearly against," "clearly for," or "other" attitude toward deschooling education. A discriminant analysis was run on the 52 "explanatory" questions to assess which of these could best account for the difference between groups. The meaning and value of the results are discussed. (Author/DWH)

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On Building an a-posteriori index from survey data: a case for educational planners' assessment of attitudes towards an educational innovation[1]

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SUMMARY

When analyzing data from a large survey it is sometimes desirable to classify subjects in the surveyed population depending on their attitudes towards certain issue, as measured by a set of questions in the survey, and then to attempt a description of this behaviour as a function of other subjects' characteristics. The analysis described in this paper is based on a survey carried out by D.J.Dicks of Concordia University in 1976 on 187 Montréal families. Responses to twelve questions of the questionnaire were identified as indicative of attitudes towards deschooling education. We address ourselves to the problems of explaining (or characterizing) these attitudes by means of some patterns exhibited within the responses given to some questions other than those twelve; and to determine the questions which best discriminate between people in terms of those clearly for versus those clearly against deschooling education.

Given that little, if any, relevant information is available on the subject, the approach taken was to build an a-posteriori index to describe the attitude under study. This index was obtained by running a canonical correlation between a set containing information from the 12 "attitudinal" questions, and another set containning information from other 52 "explanatory" questions that were selected as most relevant to our study. This analysis produced canonical variates and each of these was taken as the index for each set. Based on the actual distribution of index values, subjects were associated with a "clearly against", "clearly for", and "other" attitude towards deschooling education. Finally, having identified the two extreme groups, a discriminant analysis was run on the 52 "explanatory" questions in order to assess which of these could best explain (or account for) the difference between groups. Results showed some expected as well as surprising outcomes, the meaning and the value of which are discussed.

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TM 820 119

On Building an a-posteriori index from survey data: a case for educational planners' assessment of attitudes towards an educational innovation.

Jesús Vázquez-Abad and Karen DePauw

Introduction

The measurement of attitudes in social sciences studies, often a desirable task, still represents one of the most difficult problems faced by researchers and practitioners. The uncertainties present when a single individual is considered are not significantly overcome when a population is instead the focus of attention, as the latter situation usually entails the interplay of the "what for" of that measurement adding to the worries of the "how to".

Take as an example the case of an educational planner studying parents' attitudes towards a particular educational innovation. While the measurement of the attitudes in itself may interest him, his research would be clearly much more driven by the objectives of making such a measurement. Rather than discussing or finding theoretical bases for, say, using a particular instrument to measure with, the planner would be more likely interested in being able to characterize those attitudes in terms of socio-economic, and other, information obtained from the same population of parents. Notwithstanding the enormous importance of the validity of the instrument chosen, the planner is certainly more committed to use different kinds of information to solve problems (such as the problem of designing changes).

Measuring attitudes in an educational planning context is then a dual problem, where the "how to" and the "what for" components should be addressed to in an effort to provide the practitioners with methodologies that increase the chance of success for the resulting designs. Indeed the task often combines the threatens from a lack of sound theoretical background and the challenge of an actual problem that urgently demands a solution.

The question of the measurement in itself is often faced pragmatically. A survey is done by means of a questionnaire in which a set of items is intended to measure the particular attitude under study in the target population. The task becomes then to derive a way to cluster those data into a single piece of information. It is an usual procedure to define an index that somehow condenses whatever was measured with the chosen items of the questionnaire. This definition can be done in an a-priori or an a-posteriori way. A-priristic indices are built when it is assumed that enough appropriate knowledge on the topic exists prior to the study; this being seldom the situation in applied research, a-posteriori indices are instead built, based on what the information obtained points to, allows, or simply "suggests".

The second part, concerning the characterization of different attitudes in terms of other information, can be then undertaken by identifying a number of different subpopulations, based on some index values, and the studying the differences among those subpopulations.

In this paper an attempt is made to provide researchers in applied social sciences with a possible methodology to face the

problem of building an a-posteriori index to measure attitudes and to use such an index to explain (or characterize) these attitudes in terms of other population's attributes.

The analysis described herein has taken as its target population a sample of 187 Pointe-Claire (Montréal) families --these data taken from a survey done by D.J.Dicks of Concordia University in 1976. Upon reviewing these data, we became interested in the pattern of answers contained within three consecutive headings in the questionnaire used (see questions 47, 48 and 49 of the Appendix). Each of these headings had four items which related to it, and together these twelve questions exhibited what we considered to be an attitude towards change in education. Due to the nature of the questions, it was decided that we could describe the responses as indicative of attitudes towards "deschooling" education. With this in mind, the question was then asked: Can this attitude be explained (or characterized) by means of some patterns exhibited within the responses given to some questions other than our initial twelve? And, if so, which are the most important questions which best discriminate between people in terms of those clearly for versus those clearly against deschooling education?

Methodology

Generalities

Our first step consisted of making a quick revision of Dicks's previous results. From this analysis, it was concluded that a) very few of the respondants were Francophones (14%) and that b) very few of the respondants had an annual revenue of less than

$16,000 (18%). Furthermore, of the 300 items contained within the original questionnaire, only 52 questions (apart from the twelve measuring attitude towards deschooling) were selected as relevant to our study. Thus, in all, 64 questions were dealt with in this analysis and two of them (language and family income) were restricted to specific values. This process of selection reduced the universe of study from the original 187 to 130 families.

Building an Index

In order to be able to classify each respondant according to his attitude towards deschooling education, an index was built. This index was obtained by running a canonical correlation between a set containing information from the 12 "attitudinal" questions, and another set containing information from the "explanatory" 52 questions. This analysis produced canonical variates and each of these was taken as the index for each set. In order to differentiate between the two, the canonical variate for the first set of 12 questions shall henceforth be called the "index", while the canonical variate for the set of 52 questions will be called the "co-index".

There are two reasons for which we chose to build the index in this manner. First, the canonical correlation "builds" the canonical variates as a linear combination of the variables in each set; it then calculates the coefficients for each of these linear combinations in view of maximizing the correlation between these combinations. Thus the index and the co-index have the maximal correlation possible for any such pair of linear

comninations within the data we are working with.

In the literature of the social sciences it is not unusual to find indexes defined as a more or less arbitrary linear (or non linear) combination of some set of variables. By building an index in the manner which has been described, we can see that it features the same cha acteristics exhibited by many a-priori indexes, i.e., it summarizes the information obtained from the variables which measure the attitude in question, and it does this via a linear combination. However, it should be noted that this is not any linear combination. Because this study aims at the explanation of an attitude (summarized in the index) by means of another set of data (summarized in the co-index), it would seem wise to have the index and the co-index optimally correlated. In keeping with our data, this is exactly what canonical correlation does.

It should be mentioned here that the raw information from the 64 questions was not directly used in building the index. When working with information from a survey questionnaire, chances are that some of the items within each of the two sets which have been constructed present a high correlation between them, thus carrying redundant information. Before using the data to run the canonical correlation, therefore, it was decided that another analysis should be undertaken in order to condense the information contained in each set of questions.

The question is actually to create a set of variables from the information of the survey, such that two different sets are obtained (one for each of the original sets of items) and a low correlation is present among the variables within each of the

sets. It was decided that two separate factor analyses should be run (principal components with iterations followed by an oblique rotation). Once these analyses were run, the results showed that for the set of twelve "attitudinal" items, three factors were obtained; as for the set of 52 items, 17 factors were created. The output also contained an oblique rotation which served to 1) obtain minimal correlation between factors within each of the analyses, and 2) obtain factors which could be related empirically to some pattern in the actual questionnaire's items. The factors, which were later entered in the canonical correlation, also shown a low correlation with each other when the two groups of factors were considered together. This information was useful for it served to confirm the fact that to assume dependency would have been a faulty assumption. Hence, it also served to show that there was no sound basis which would have allowed us to "explain" the attitudes by means of, for instance, multiple regression.

Having performed the canonical correlation between the two sets of derived factors, we obtained as an output the computed values of the index and co-index for each of the subjects in our study. It should be noted that, due to the missing values of some items, which lead to missing values on factors and canonical variates, our population was reduced further.

Identifying subpopulations with the Index

The next step consisted of developing a criterion necessary in order to use the index values as a population classifier. Many such criteria could be developed, all of which are simple in na-

ture. For instance, one could use simple arithmetics, descriptive statistics, or a combination of both in selecting the index values which best breakdown the population.

Let us briefly look at these criteria. The first criterion involves computing by hand the index values in several hypothetical situations. For example, if a family answered number 4 to each question contained within the third heading (see question 49 of the Appendix) and number 1 to each question in the first two headings (see questions 47 and 48 of the Appendix), we could conclude that the family would have a clearly positive attitude towards the innovation. Another family answering number 4 to the first two headings and number 1 to the third one could be seen to exhibit a clearly negative attitude towards deschooling education. In the first case, the answers would lead to a computed value of -10.78 for the index, whereas in the second case the index would have a value of 4.91 . Moreover, it should be noted that these two numbers are actually extreme values for the index, and that from the formula obtained from our calculation, one can see that the index value increases linearly with the third factor of the attitudinal set and almost negligeably with the other two factors. A simple table of possible values for typical answers is given in Table 1. The resultant criterion might be referred to as an absolute one, in view of the fact that it doesn't depend on the actual answers obtained but only on the arithmetic properties of the index. The next step is to select a value which will be used to classify individuals as either clearly for or clearly against deschooling education. For example, one could choose an index

value of "less than -8.1" as representative of a family favoring deschooling, and an index value of "greater than 2.3" as representative of a family against deschooling.

This criterion has the disadvantage that, because it is built without regards to the actual index values of the population, one can finish the analysis with an empty set on one or both sides. One could find, for example, that no family falls within the "pro deschooling" group, that is, no family have an index value of less than, say, -3. This result would be of little value (except from the fact that it could be said that attitudes were polarized around one end of the scale).

The second criterion which might be used in calculating the index values has a more empirical basis. This criterion would involve taking into account the actual distribution of the index in our study population. By taking this into account, we could decide to associate families with an index value to the "left" of the mean index value minus one standard deviation, as those exhibitting an attitude in pro of deschooling education. On the other hand, those families located on the right of the mean plus one standard deviation could be considered to be against deschooling. It should be noted that more than one standard deviation could be taken, but then the possibility of ending with an empty set again increases. In using this criterion we could not be entirely sure that the two sets generated would necessarily be related to the respective attitudes. However, this criterion more or less ensures that the two sets are adequately distanced from one another, provided that there does not emerge from the calculations a pronounced

leptokurtic distribution for index values.

As in the case of using arithmetics for selecting the critical values for making the classification, it has the disadvantage of being possible to obtain an empty set on one or both sides. Thus, one could choose a combination of both criteria in order to generate two non-empty and disjoint sets while keeping in mind the fact that they must bear an actual value for analytic purposes (i.e. that the index gap is large enough, that resulting sets have enough subjects, etc.)

For the purposes of our study it was decided that the statistical method (the second one explained above) would be appropriate. We then proceeded to break our population into three groups. These groups consisted of 1) families clearly in favor of deschooling education, 2) families clearly against it, and 3) families falling into neither of these two categories. However, before proceeding to the final step in our study, it was decided that a t-test should be run in order to assure us that other overall characteristics weren't different among extreme groups apart from the information condensed in the index. Thus a t-test was run on the co-index values for the extreme groups.

Identifying discriminating characteristics

Finally, having identified the two extreme groups, a discriminant analysis was run on the "explanatory" 52 items, in order to assess which of those could best explain (or account for) the difference between pro and aginst groups. Needless to say that the output from discriminant analysis, in addition to its analytic

purposes, could be further used for classificatory ends (which might be a piece of information with great interest for the planner).

Results and Discussion

For the sake of clarity and conciseness, we shall proceed with the results of each analysis in the order they were conducted.

As stated above, a factor analysis was first conducted so as to eliminate redundant information. The result of the factor analysis on the twelve "attitudinal" items is shown in Table 2. A few observations need be noted here. First, if we look at factor 2 we can see that the variables which bear the most weight are the last four. These were the items forming question no. 49. Thus, factor 2 strongly identifies with this one question.

With regards to factors 1 and 3 the results show that the values are "crossed". That is, in factor 1 the items COMEDA to COMEDD bear the strongest weight while the first four items in the table exert a lesser influence. This outcome is reversed in the case of factor 3. As was the case for factor 2, each of these four sets of items represent a question. Thus, factor 1 strongly identifies with question no.48 while factor 3 strongly identifies with question no. 47

That the factors group in this manner is of interest because it indicates that the respondants answered similarly for the four questions contained under each heading. However, there was reason to believe that a certain degree of variety in individual responses could have been expected. For example, an individual could have answered that home education was compatible but

not better. This situation was apparently not borne out by the results. In view of this, we would venture to say that the questionnaire promotes bias in terms of the responses because of the way it was constructed.

Factor analysis was performed on the 52 "explanatory" items. The result was an output listing 17 factors; we don't feel necessary to reproduce this results here since the value of this analysis is in terms of its use in subsequent analyses. Suffice it to say that the items appeared to be more or less independent in terms of their contributions to different factors.

The next step consisted of performing a canonical correlation. The result of this analysis is illustrated on Table 3. As can be seen from this table, the factors have been separated into two groups --factors 1 to 3 representing the "attitudinal" information and factors 4 to 20 representing the "explanatory" information. From this point on, we shall be referring to the canonical variate for the former as the index, and the one for the latter as the co-index. What should be noted with regards to Table 3 is that the index is influenced to the greatest extent by factor 3, and the co-index by factors 5 and 9. The second part of the output of this analysis produced a matrix of correlations between each of the factors. The importance of this part of the analysis was that it allowed us to ascertain that there was little correlation between each of the factors (with the exception of factors 1 and 3 --the result being anticipated from the output of the first factor analysis).

With these canonical variates we are now able to calculate a value for the index. As was stated before, the method chosen to calculate this was that involving descriptive statistics. In order to obtain the information necessary to selecting appropriate values for the index, we ran a simple descriptive analysis. Results are shown in Table 4. From this analysis we were able to determine that our population had been reduced, because of missign values, from the original 130 to 95. We can also see that the mean value for the index is located towards one end of the scale, which means that in absoulute terms the population surveyed tends to be more negative than positive towards deschooling. This will also imply that more families be found in one group than in the other.

The next step was to choose a value so that enough subjects would fall into each group while keeping the maximum distance between the two groups. It must be remembered that the purpose of creating an index was to enable us to clearly distinguish between those respondants in favor of deschooling and those against. It was decided, therefore, that those respondants whose index value was situated more than 1 standard deviation away from the mean in either direction would be included in the subsequent analysis.

A t-test was now conducted. This analysis allowed us to determine how successfully were we in differentiating between the two populations. The result is shown in Table 5; from this table we can see that 11 people fell into the "pro" group and 16 into the "con" group, thus our population has been finally reduced to only 27 families.

We proceed now with the final step, the discriminant analysis, in which we used the Wilkes type and the stepwise procedure. Results yielded by this analysis are shown in Table 6.

The final result, therefore, lists fourteen variables, some of which were expected but most of which were not obvious at the start. That EDPERS, for example, should be included among the fourteen is a surprising result: one would assume that different people's opinions concerning the value of education for personal development would make no impact in their opinion about deschooling education. Education of the respondant, in contrast, is one of the variables one would most likely expect to contribute making a difference in attitudes towards the innovation. Other variables such as "communication is pleasant" are also unclear in terms of how people would differ in terms of their opinion in this question. On the other hand, a pattern might be seen in that EDSKL and EDDIP (the more traditional functions of education) might be favored by the group against deschooling education while EDSPO and ADEDREC might be indicative of a new attitude towards education (which moves away from ideas of what is appropriate material for education and what is the "proper" lieu of its occurrence)*. It might be of interest to pursue these findings further in order to deepen in the understanding of human attitudes towards deschooling education; for our hypothetical educational planner working with the particular population surveyed, however, the information obtained from the analysis thus far may be enough to satisfy his needs.

* A résumé of the results is offered in Table 7.

Conclusion

In this paper a methodology has been proposed to address the problem of measuring an attitude in a population and characterizing the subjects as a function of such measurement.

The methodology has been illustrated for the example of measuring attitudes towards deschooling education; the target population and the data were obtained from a survey conducted by D.J.Dicks on 187 Pointe-Claire (Montréal) families. Results indicated that data from 14 selected items would best discriminate between people clearly against and clearly for such an educational innovation.

Concerning the methodology, two major problems can be pointed out here. The first concerns the reduction of the population size entailed in the process of building the index: in our example, from the original 130 families (after the preliminary elimination) only 27 could be used to set up the extreme groups as well as they constituted they only input to the discriminant analysis (and, thus, all results derive just from these small sample). This reduction, due to the large number of items from the questionnaire that were considered in this study, may be a problem when initially smaller populations are studied; but it can nevertheless be overcome if an appropriate mechanism is included in the survey procedure in order to reduce the amount of missing information as possible.

The second problem concerns the nature of the statistical tools used here. Some of these are analyses indeed intended to work on interval or ratio data whose joint distribution has

shown to be multinormal. This is obviously not the situation with the data we had at hand, nor will it be the case of most studies where data come from a survey whose items are answered in a Lickert-type of scale. However, we felt that given the lack of more appropriate analysis, or the impracticality of existing ones in such a large study, we were better off by using tools whose aims were coincident with what we were looking for. We accept threatens to our study coming from criticisms on the precision, robustness, or generalizability of the results. But for the applied researcher and the practitioner it still represents a way to solve practical problems, which is better than what was available to them before.

Acknowledgement

Dr. D.J.Dicks provided the data and the sample questionnaire that were used in this study. All analyses were run using the Statistical Package for Social Sciences in the Concordia University's CDC Cyber 172.

TABLE 1

VARIABLE	$\bar{X}$	C	Z SCORES FOR ANSWERING 1	2	3	4	FACTOR-SCORES COEFFICIENTS F1	F2	F3
HOMEDA	3.039	1.034	-1.97	-1.01	0.04	1.33	.40	NS	.31
B	1.202	0.952	0.32	-1.25	-0.21	0.84	.47	NS	.12
C	2.446	1.046	1.66	0.80	0.35	1.21	.49	NS	.85
D	3.281	0.855	2.67	1.95	0.53	0.38	.54	NS	.55
COMEDA	2.844	0.977	-1.89	-1.56	+0.16	1.18	.85	NS	.41
B	3.094	0.921	0.71	-0.56	-0.10	0.85	.92	NS	.43
C	2.611	0.978	-1.01	-1.19	0.35	0.37	.88	NS	.50
D	3.010	0.894	0.24	-0.17	-0.01	1.13	.84	NS	.45
REDEDA	2.347	1.014	-1.32	-0.84	0.04	1.61	NS	.97	NS
B	2.402	1.058	-1.33	-0.53	0.27	1.51	NS	.96	NS
C	2.294	1.011	-1.20	-0.29	0.30	1.69	NS	.92	NS
D	2.465	1.010	-1.45	-0.46	0.53	1.52	NS	.94	NS

FACSCORES FOR SPECIAL ANSWERS	HOMEDA TO COMEDD = / REDEDA TO REDEDD =	1 / 4	2 / 3	3 / 2	4 / 1	INDEX COEFFICIENTS
FAC 1		-11.53	-5.65	+0.18	+6.02	-0.031
FAC 2		+5.80	+2.31	-1.39	-5.10	-0.098
FAC 3		-11.56	-5.83	-0.10	5.63	+1.007
INDEX VALUE		-10.78	-5.92	0.03	4.91	

TABLE 2

FACTOR ANALYSIS IN VARIABLES TO BE EXPLAINED
FILE ET641 (CREATION DATE = 79/07/19.)

OBLIQUE FACTOR STRUCTURE MATRIX
AFTER ROTATION WITH KAISER NORMALIZATION

DELTA = 0

	FACTOR 1	FACTOR 2	FACTOR 3
HOMEDA	.40487	-.03574	.91323
HOMEDB	.46799	.05506	.91733
HOMEDC	.48271	-.02539	.85332
HOMEDD	.54181	.01708	.88181
COMEDA	.88950	.00891	.49190
COMEDB	.92056	.19081	.42613
COMEDC	.87809	.02134	.50217
COMEDD	.93665	.13194	.48941
REDEDA	.11159	.96651	-.02762
REDEDB	.07323	.95734	.02832
REDEDC	.11862	.92237	.03314
REDEDD	.08002	.93979	-.03179

TABLE 3

COEFFICIENTS FOR CANONICAL VARIABLES OF THE SECOND SET

	CANVAR 1
FAC4	.00325
FAC5	.51942
FAC6	-.00729
FAC7	.04372
FAC8	-.14058
FAC9	.51239
FAC10	.12253
FAC11	.09510
FAC12	.37313
FAC13	.19255
FAC14	-.08155
FAC15	.18071
FAC16	-.27345
FAC17	.18139
FAC18	-.13503
FAC19	-.00251
FAC20	-.08512

COEFFICIENTS FOR CANONICAL VARIABLES OF THE FIRST SET

	CANVAR 1
FAC1	-.03052
FAC2	-.09825
FAC3	1.00652

TABLE 4

VARIABLE INDEX

MEAN	-.000	STD ERR	.103	STD DEV	1.000
VARIANCE	1.000	KURTOSIS	.232	SKEWNESS	-.434
MINIMUM	-2.718	MAXIMUM	2.392	SUM	-.000
C.V. PCT	.1055E+10	.95 C.I.	-.204	TO	.204

VALID CASES 95 MISSING CASES 35

TABLE 5

VARIABLE	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	F VALUE	2-TAIL PROB.
COINDEX						
GROUP 1	11	.9010	1.016	.306	1.01	.959
GROUP 2	15	-.6710	1.012	.253		

POOLED VARIANCE ESTIMATE			SEPARATE VARIANCE ESTIMATE		
T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.	T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.
4.72	25	.000	4.71	21.60	.000

TABLE 6

Meaning of Code

EDJ1	-715.53680	.....Education of respondant
CRSE	-15682.21779	.....Watching Educational TV
RADCRS	91.58576	.....Educ. for credit via radio
EDPERS	15734.31951	.....Educ. for personal development
EDSKL	-441.96588	.....Educ. for getting job skills
EDDIP	1518.18344	.....Educ. for getting diplomas
EDSPO	2956.37652	.....Educ. for sports and activities
ADEDREC	-14949.33635	.....Adult educ. Taking recreational courses
ADEDPX	-1445.53791	.....Adult educ. The price is right
ADEDMAL	-49.34391	.....Correspondence course
ADEDSHP	-9790.69211	.....Course in shop
TELPLS	5342.30143	.....Communication is pleasant
TELCONF	454.15379	.....uses conference telephone
TELPIC	6599.01393	.....Uses picture telephone

TABLE 7

Most discriminating factors between the two groups

	Group 1 (pro deschooling)	Group 2 (against deschooling)
Background	Have had more years of schooling	
Attitudes towards Education	Place more emphasis on the importance of obtaining job skills as a goal	Place more emphasis on the importance of personal development as a goal Place more emphasis on the value of obtaining diplomas and degrees
Attitudes towards information technology	Show a more positive attitude towards the possibility of watching educational programs on TV Find that using the telephone, telex, computers, and data processing equipment is a pleasant activity	Disagree with the idea of making greater use of radio in providing education for credit For the most part, have never used the conference telephone For the most part, have never used the picture telephone
Attitudes towards adult education	Find that taking courses at a shopping mall is convenient Are more interested in taking adult education courses for recreational purposes	Find that fees for adult education courses are appropriately priced